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Canada

ON GALL STRUCTURES.

BY MISS A. C. ROOPER.

THE history of Gall Structures presents so much that is interesting, that a few more remarks about them will, I hope, be welcome to the readers of the P.N.E.U. magazine. But before giving any description of these curious nurseries for the infant stage of some animal life, it is necessary to give a brief account of their insect builders. Naturalists have generally arrived at the conclusion that they are formed by the influence exerted by juices extracted from the larvæ as they grow and develop on the surrounding vegetable-tissue. The insects which have this power are very numerous, and consist of gall-flies, gall-gnats, gall-lice, and gall-wasps. Of these different families, that of the gall-wasps, the makers of the well-known oak-apple and its varieties, are the most important. They are small four-winged insects, and to the casual observer they are much more like flies than wasps, but they are nearly allied to wasps, whereas flies belong to a different order of insects. The bodies of these gall-wasps, like those of the members belonging to the same natural order (the Hymenoptera), terminate in a somewhat complicated instrument, which is capable of being more or less withdrawn into the body, but with which they can pierce buds and leaves and push their eggs to the bottom of the holes thus produced. The instrument itself consists of a stiff grooved sheath, in which lie two stiff hairs with sharp notched points, which can be thrust out further than the sheath. The eggs are of a peculiar form—pear-shaped—having a long stalk five or six times the length of the body of the egg, so when the eggs are lying at the bottom of the holes, the end of the stalk is near the surface. By this means communication is kept with the air. The galls formed by these gall-wasps are generally to be found on oak-trees, but it is by no means a rule. One of the most beautifully-shaped grows chiefly on the under side of the young buds

and branches of one species of oak. It is a very small one, of a dark brown colour, tinged with bluish-white; it has numerous short conical projections, and is firmly attached to the branch or bud at the base by a very short foot-stalk. It contains a single larva cell, which is the home of the gall-maker from December till the following March. To the gall-wasp is due the ink-making galls of commerce. They are formed in the axils of a shrubby piece of oak, growing in the Levant; they are of a comparatively large size, of a reddish-brown colour, bare, but covered with projections. On our British oaks there are some galls which also contain ink-making properties, but not in sufficient strength and quantity to manufacture ink. These galls are known as the Devonshire galls, because they were first noticed in that country. In shape they are curiously like an acorn in every detail; the difference is that the cup is smaller and the spherical body larger than in the true acorn. Another pretty gall is to be found in May, in the flowers of the oak. Its outward appearance is an abnormal size of the stamen, which also assumes a delicate greenish-yellow hue. The so-called spangled galls are also pretty objects on the under side of many oak leaves. They consist of brown spherical patches, the snug homes of the larvæ of a gall-wasp from November till May, for when the leaves fall in the autumn they generally settle on the ground with their under surfaces resting on it, so that the gall is safely esconced between it and the upper surface of the leaf until the spring comes, when the full-grown occupant emerges into the air, having cut its way through its winter covering.

These gall insects are very fastidious about the place where they will lay their eggs, and it is astonishing with what care they search out spots difficult of access and also favourably situated with regard to the supply of food for the safe habitation of their offspring during the larval stages. One such instance is to be found in the small gall-wasp, which lives upon the fig, cultivated in the south of Europe. It must be remembered that a fig when cut open lengthways, shows that it is really an urn or pear-shaped receptacle, containing a whole collection of flowers, which are very simple in structure. They are of two kinds, those with seed vessels only, *i.e.*, female flowers, and those with stamens only, *i.e.*, male flowers. The female flowers are again divided, for some have long styles and some short, and these latter are called gall-flowers. The reason that they are so called is as follows:—the little gall-wasp creeps through the orifice at the top of the urn, and deposits its egg right into the middle of one of the female flowers; should it be one of the short-styled ones the egg reaches the ovary, which the white larva speedily fills, and it becomes a gall, where the insect passes its larval stage, till the time comes for it to issue a full-grown wasp, creeping up to and out from the orifice of the urn into the external world. If, on the other hand, the wasp should deposit its egg in a long-styled flower, it is out of reach of the ovary, and being without a suitable home, the larva perishes, and the flower develops in the normal way. Such are some of the forms of galls produced by gall-wasps, but the real variety in shape, colour, and position of these and of the other gall structures is so great and wonderful that it is an ever-developing study in itself, and I can do no more in this brief paper than describe a few specimens of some of the other groups of this large section of organic life.

A large number of them are grouped together under the name of mantle-galls. The insects which produce them spend their lives on the surface of the leaves, where they multiply and attach their eggs. In some cases the evidence of their presence consists in the blade of the leaf instead of being spread out flatly as it normally would be, grows more luxuriantly on the one side than on the other, and the result is the formation of a scroll or chamber where the insects lie hidden. In the Alpine rose, the crane's bill, and brache, it is the upper side which is tenanted by the insects, and therefore the one to roll up; in the buckthorn, the hawthorn, and the dwarf species of honeysuckle, it is the lower side. The parts of the tissue brought into contact by the rolling do not coalesce, and therefore the hollow space in which the gall-makers live is always in open communication with the exterior. The tissues forming these galls are thickened and generally of a bright red colour. On the leaves of the red currant in the summer a very common gall structure may be noticed. It has the appearance of several wrinkles united into large blister-like protuberances, red on the

outside, and covered with jointed cellular structures bearing glands which look to the naked eye like short hairs.

Another form is that to be seen on the leaves of the sloe, the bird-cherry, the alder, the thyme, and many more trees and shrubs. It resembles a nail or a horn driven through the leaf in its hollow, and the cavity generally opens on the under side of the leaf. The inner wall and mouth of the cavity is covered with hairs, so that the aperture is quite closed by them. Then there are the so-called cluster-galls, which consist of densely-crowded leaf-structures, in the chinks and recesses of which the gall-makers pass the whole or a portion of their lives. Whilst the shoot is still growing and not fully developed, the influence exercised by the insect causes the axis to shorten, and thus the leaves or twigs become condensed and assume various shapes, such as a rosette (which may frequently be seen on the tops of willow twigs, and are called willow roses), or a miniature birds'-nest (an object visible on hawthorn bushes), or a cluster of twigs—the "witches' brooms" (so often to be noticed on pine trees and birch trees), or a kind of pig-tail (to be seen on various trees). Specimens of gall structures are also to be found on the flowers, stems and roots of plants, all producing more or less interesting and curious abnormal growths worthy of the observation of the diligent seeker after Nature's secrets.